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MOTOROLA INC. COMMUNICATIONS DIVISION - INSTRUCTION

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MOTOROLA

Test Equipment

DEVIATION METER

MODEL S1323
and
SLN-1005A

68-81069A07-0

MOTOROLA

DEVIATION METER

MODEL S1323
and
SLN-1005A

MODEL S1323 and SLN-1005A

MOTOROLA INC. **Communications Division**

ENGINEERING PUBLICATIONS 4501 WEST AUGUSTA BOULEVARD CHICAGO, ILLINOIS 60651

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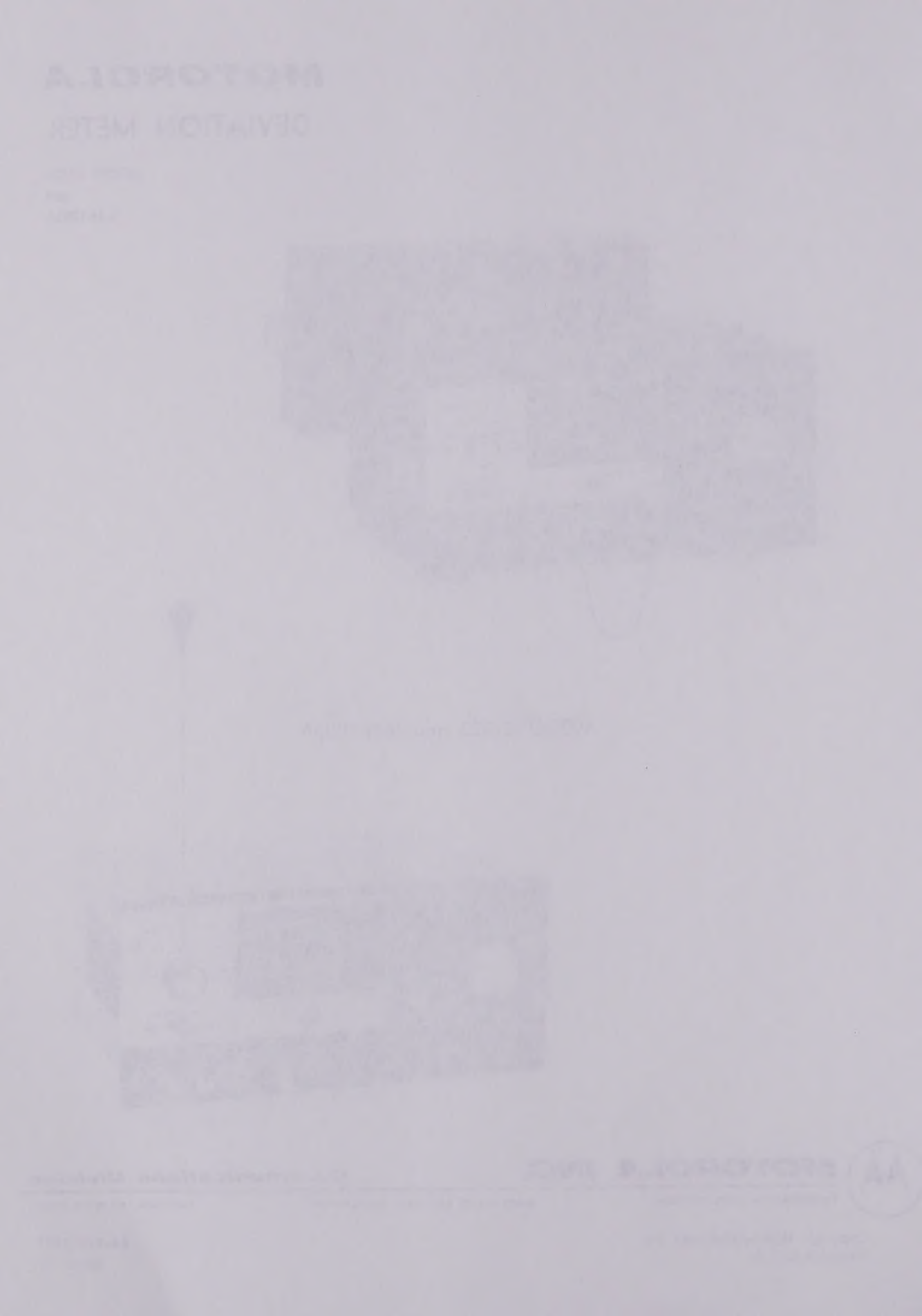

FORWARD

SCOPE OF INSTRUCTION MANUAL

The equipment covered in this instruction manual was manufactured for Motorola Communications & Electronics Inc. by Measurements Corporation, a McGraw-Edision Division. The information in this manual is based on data supplied by Measurements Corporation and is reproduced with their permission.

NOMENCLATURE

Motorola test equipment is specifically identified by the model number on the nameplate. Be sure to use the entire model number when making inquires about your equipment.

INSTRUCTION MANUAL REVISIONS

Changes which occur after an instruction manual is printed are described in the Instruction Manual Revision. These bulletins give the reader complete information on the change including pertinent parts listing data.

STORAGE

Remove dust from controls and outer surface of instrument with a clean rag. Wrap instrument in heavy wrapping paper and seal seams with gummed tape or similar adhesive. Store in a dry place. If excessive humidity is unavoidable, the wrapped instrument should be placed in a moisture-proof bag with a sufficient quantity of drying agent, such as silica gel, to insure a dry atmosphere. When the use of bag and desiccant is necessary, the instrument should be checked at six-month intervals to determine the effectiveness of the seal.

SHIPMENT

Wrap the instrument with a heavy wrapping paper and seal seams with gummed tape or similar adhesive. Place in fibreboard carton or wooden box large enough to permit at least three inches of excelsior or similar packing material between the instrument and sides of the box. For export packing, the instrument must be wrapped in water-proof paper and the seams sealed with water-proof glue or similar sealing compound before being placed in a wooden box.

PARTS AND SERVICE

CAUTION

Read the "Maintenance Precautions" section of this manual before attempting to open or service the deviation meter. Only maintenance procedures specifically covered in the manual may

be performed in the field without danger of serious damage to the equipment. If any other maintenance is required for this instrument, pack the instrument as indicated above and ship to:

Measurements Corporation
Intervale Road
Boonton, New Jersey 07005

When ordering replacement parts, the complete number identification of the item must be used. Motorola Parts Depots are located at the following addresses:

2333 Utah Avenue, El Segundo, California 90245
Tel: 213-644-1101 – TWX: 910-348-6278

1170 Chess Drive, San Mateo, California 94404
Tel: 415-349-3111 – TWX: 415-375-3877

Lake Mirror Road, Forest Park, Georgia 30050
Tel: 404-366-6035 – TWX: 810-751-3185

1875 Greenleaf Avenue, Elk Grove Village, Illinois 60007
Tel: 312-439-7150 – TWX: 910-222-2868

15-00 Pollitt Drive, Fair Lawn, New Jersey 07410
Tel: 201-791-1700 – TWX: 710-486-7836

3220 Belt Line Road, Dallas, Texas 75207
Tel: 214-241-2151 – TWX: 910-860-5505

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	Filter Printed Circuit Assy.	1P84308A83
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1. GUARANTEED PERFORMANCE SPECIFICATIONS

a. Carrier Frequency Range: 25 – 1000MHz (25 – 50 MHz local oscillator provides useful harmoni to 1000 MHz).

b. Sensitivity: 25 millivolts at frequencies to 500 MHz; 50 millivolts to frequencies of 1000 MHz.

c. Residual Frequency Modulation: Less than 100 Hz at 500 MHz.

d. Input Impedance: Nominally 50 ohms.

e. Deviation Ranges: 0 to 2 kHz, 0 to 6 kHz, 0 to 20 kHz.

f. Deviation Accuracy: ± 3% of full scale.

g. Modulation Frequency Response: Flat from 100 Hz to 8 kHz.

h. Input Gain Control: Linear taper potentiometer provides 26 db of attenuation.

i. Maximum Power Input: 200 milliwatts.

j. Speaker Output: Provides a 750 micro-second de-emphasis network. This jack may be used to drive the 8 ohm speaker provided in the front cover. The level of de-emphasized audio output may be adjusted with the AUDIO LEVEL control.

k. SCOPE Output: Provides a linear audio output from an emitter follower.

l. Power Supply: A well regulated power supply operates off a 115 volt 50-60 Hz line. Provision is also made for battery operation. Three Eveready rechargeable batteries #563 or their equivalent may be used. Nine ',D" size cells may also be used. Maximum power consumption is 3 watts.

m. Weight: (less batteries) 8 lbs.

n. Dimensions:

Height	5"
Width	9.5"
Depth (less cover)	7.5"

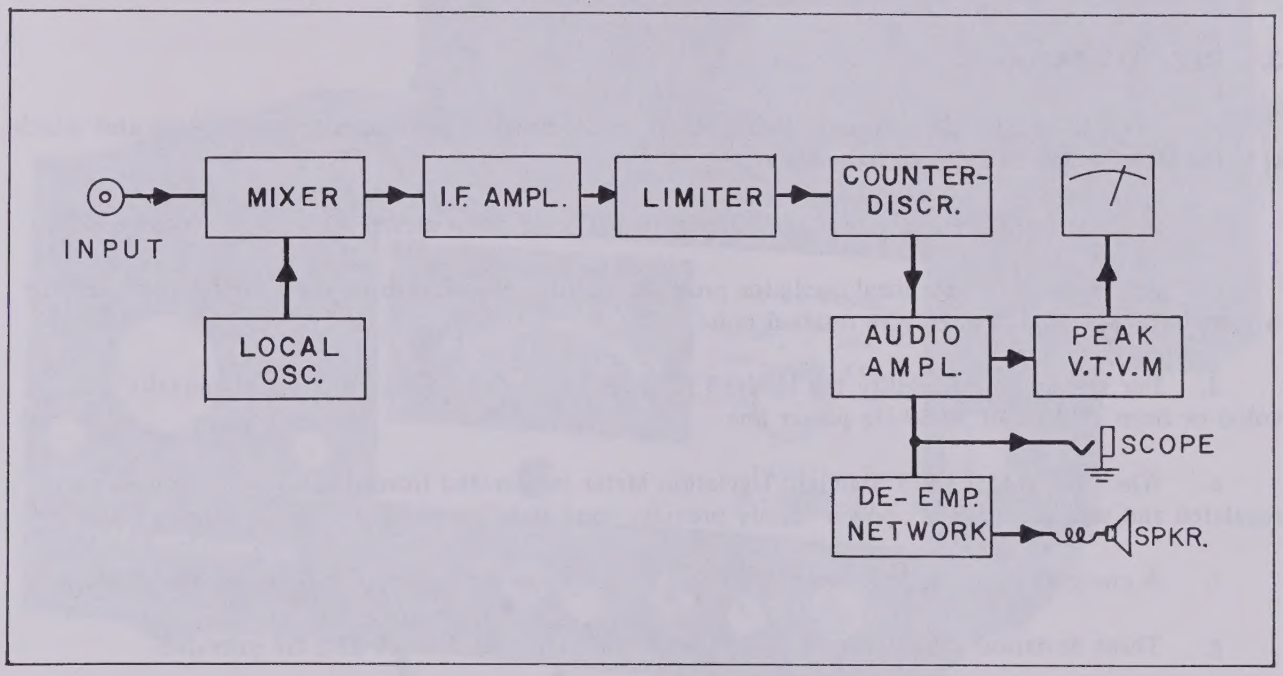
MOTOROLA NUMBERS FOR DEVIATION METERS

Model	Supplied Complete With:
1323	SLN-6339A – Deviation Meter (Basic Unit) SLN-6340A – Case Assy. (With Top Handle & Hardware) SLN-6341A – Front Cover W/Speaker SPN-6203A – Power Supply Less Batteries (Back W/Battery Holders, Slide Switch, Hardware, Etc.) SKN-6016A – Power Pack Assy. (Rectifier, Transformer, Housing, Power Pack, Etc. For 115V 60 Hz)

Continued

MOTOROLA NUMBERS FOR DEVIATION METERS (Continued)

Model	Supplied Complete With:
SLN-1005A	SLN-1005A – Deviation Meter W/Dust Cover Housing. (Consists of: SLN-6339A & SLN-6343A) SLN-6343A – Dust Cover Housing



Block Diagram for the Model 1323 Standard Deviation Meter

2. DESCRIPTION

a. GENERAL

1. The Model 1323 Deviation Meter is designed to accurately measure the peak frequency deviation of frequency modulated communication transmitters.

The Model 1323 contains an accurate, linear, counter-type discriminator and a reliable peak reading voltmeter.

The highly stable conversion oscillator allows measurement at frequencies from 25 to 1000 MHz with low inherent residual frequency modulation and maximum freedom from drift. To extend the useful range of the instrument below 25 MHz, an external oscillator may be used to heterodyne transmitter frequencies to the 100 kHz intermediate frequency.

A discriminator output is available from the two front panel jacks labeled SCOPE and SPKR. The output from the SPKR. jack includes a 750 micro-second de-emphasis network which allows the Model 1323 Deviation Meter to be used as a standard receiver meeting the requirements of EIA Standard

RS-152-A. Considerable care was taken in the manufacture of the Model 1323 to insure low inherent noise and distortion compatable with the EIA Standard. The SPKR. jack provides a convenient source for measurements of distortion and noise, or it may be used to drive the 8 ohm speaker provided in the front panel cover.

The SCOPE output jack provides a linear output from the discriminator, and therefore noise and distortion measurements may be made without the de-emphasis network.

The output of both the SPRK. jack and the SCOPE jack may be viewed on an oscilloscope.

3. DESIGN FEATURES

a. The Model 1323 Standard Deviation Meter is a completely self contained solid state unit which is portable, accurate, and simple to operate.

b. Measurements are easily read on a linear, taught-band panel meter.

c. An extremely stable local oscillator provides useful harmonics up to 1000 MHz. This ocillator is completely shielded to minimize residual noise.

d. For maximum portability the Model 1323 may be powered from batteries, (nominally 13.5 volts) or from a 115 volt 50-60 Hz power line.

e. When the Model 1323 Standard Deviation Meter is operated from the AC power line, a well regulated and well filtered D.C. power supply provides good stability and low residual hum and noise.

f. A charging circuit is provided to recharge rechargeable batteries up to their nominal voltage.

g. Three deviation ranges from 0 to 2 kHz, 0 to 6 kHz, and 0 to 20 kHz are provided.

h. SPKR. Output is provided along with an 8 ohm speaker mounted in the front cover. The speaker output includes a 750 micro-second de-emphasis network, and a level control.

i. SCOPE Output is available from a front panel jack. This output is linear and may be viewed on an oscilloscope.

j. A deviation (+) (-) switch allows the measurement of peak deviation on both sides of the carrier.

4. CONTROL FUNCTIONS

a. POWER

1. The three position POWER SELECT switch located on the back of the 1323 selects either AC Line Operation, Battery Operation or Battery Charge position.

2. The ON-OFF switch on the front panel controls the application of bias voltage to the circuits of the Model 1323.

Front View of The Model 1323 Standard Deviation Meter with Case and Front Cover, including Speaker, and with Power Supply.

3. The fuses located, one in the back of the instrument, and one in the A.C. Power Pack protect against overloads.

b. INPUT GAIN CONTROL

1. This is a linear potentiometer which adjusts the gain of the signal applied to the metering circuits. Approximately 26 db of attenuation is possible.

c. LOCAL OSCILLATOR TUNING

1. This dial controls the tuning of the local oscillator which operates between 25-50 MHz. The local oscillator has useful harmonics to 1000 MHz and is mixed with the incoming signal to produce the 100 kHz intermediate frequency.

d. FINE TUNING

1. This control permits extremely fine electonic adjustment of the local oscillator frequency to facilitate tuning.

e. METER RANGE SWITCH

1. This switch selects the meter function as described in the following:

A. BAT: In this position the meter checks the D.C. supply voltage necessary for accurate operation. If the POWER SELECT switch SW3 is in the A.C. position the meter indicates the rectified and filtered A.C. voltage. This reading should be somewhere in the portion of the meter marked BAT.

If the POWER SELECT switch is in the BAT. position the meter indicates the battery voltage. The battery voltage should indicate three quarter scale or greater. A line indicating minimum battery voltage is marked on the meter scale. If the battery voltage is low the batteries should be recharged as per instructions Section 5 Paragraph c.

NOTE

DO NOT ATTEMPT TO RECHARGE NON-RECHARGEABLE BATTERIES.

B. TUNE: In this position the meter will peak when the local oscillator is adjusted to produce a 100 kHz beat with the incoming signal.

C. 20 kHz, 6 kHz, or 2 kHz; these positions select the desired meter deviation range.

D. CAL 1: This position is used only when checking the discriminator.

E. CAL 2: This position is used to check the gain of the audio amplifier.

f. AUDIO SPKR: This front panel jack provides a low impedance output for speaker connections. This output circuit contains a 750 micro-second de-emphasis network.

g. AUDIO LEVEL: Controls the output level from the SPKR. jack.

h. SCOPE: A front panel jack which provides a linear audio output.

i. + DEVIATION – : This switch allows the measurement of deviation on both sides of the carrier.

5. POWER SUPPLY

a. BATTERY OPERATION

1. The Model 1323 may be used with three #563, 4.5 volt rechargeable Eveready batteries or their equivalent, or with nine standard "D" cells.

The following procedure should be followed to battery operate the Model 1323:

A. Disconnect the AC power pack.

B. Slide the power select switch on the back of the instrument to the BAT. position.

C. Rotate the METER RANGE switch SW1 on the front panel to BAT. If the meter reads above the three quarter scale as indicated by the BAT. marking on the meter, then there is sufficient battery voltage for accurate operation.

D. If the meter reads below the BAT. mark then the batteries should be replaced or re-charged to insure accurate operation.

b. A.C. OPERATION

1. The Model 1323 may be operated from a 115 volt 50-60 Hz source of line voltage as follows:

A. Connect the A.C. Power Pack provided with the Model 1323 between the connector on the back of the case and the A.C. plug.

B. Slide the POWER SELECT switch SW3 located on the back of the case to the A.C. position. The instrument is now ready for operation.

c. BATTERY RECHARGING PROCEDURE

CAUTION

DO NOT ATTEMPT TO RECHARGE NON-RECHARGEABLE BATTERIES.

1. The Model 1323 has a built-in charging circuit for maximum convenience in recharging run down batteries.

If the BAT. check position indicates that the battery voltage is low connect the A.C. Power Pack between the Model 1323 and the A.C. power line and switch the POWER SELECT switch SW3 on the back of the instrument to the CHARGE position. The batteries are now being charged. It is not necessary to have the front panel POWER switch in the ON position to charge batteries.

A full scale meter reading in the BAT. check position indicates that the batteries are charged to their nominal voltage of 13.5 volts. This is the ideal maximum voltage to which the batteries should be charged.

An overnight charge is recommended. A longer charge will not harm the instrument although the useful battery life may be shortened. Do not charge batteries more then approximately 10 hours after 13.5 volts has been reached. The actual number of hours necessary to recharge the batteries is dependent on the battery voltage at the start of the charge and the number of times that the batteries have been recharged previously. Alkaline magnesium batteries have good retention qualities and normally require no trickle charge.

6. OPERATING PROCEDURE

a. DEVIATION MEASUREMENTS

The following procedures are identical for either battery or A.C. operation.

NOTE

WHEN FIRST MAKING DEVIATION READINGS WHERE SIGNAL STRENGTH IS UNKNOWN, IT IS BEST TO LOOSELY COUPLE TO THE TRANSMITTER UNDER TEST OR TO USE AN EXTERNAL ATTENUATOR. THIS PROCEDURE PROTECTS THE MIXER DIODE CR4 FROM OVERLOADS.

1. Place the METER RANGE switch in the TUNE position and rotate the LOCAL OSCILLATOR TUNING to obtain a peak meter reading. This will be obtained whenever the local oscillator (fundamental or harmonic frequency) is exactly 100 kHz away from the input frequency. When the transmitter frequency is between 25 and 50 MHz, the fundamental frequency of the local oscillator is used. When the transmitter is above 50 MHz, harmonics of the local oscillator will produce the desired 100 kHz difference frequency. The following chart lists dial readings that may be used at various mobile transmitter frequencies.

Mobile Transmitter Frequency (MHz)	Model 1323 (±100 kHz)	Harmonic
25 to 50	25 to 50	Fundamental
50 to 54	25 to 27	2nd
129 to 141	43 to 47	3rd
141 to 150	47 to 50	3rd
150 to 160	37.5 to 40	4th
160 to 174	40 to 43.5	4th
396 to 432	44 to 48	9th
432 to 450	48 to 50	9th
450 to 470	45 to 48	10th
874 to 912	46 to 48	19th
912 to 950	48 to 50	19th
950 to 960	47.5 to 48	20th

2. Adjust INPUT GAIN to bring meter pointer within blue area of the scale. If necessary, reduce coupling to the transmitter under test, or use an external attenuator to allow peaking in the blue area.

NOTE

WHEN USING HARMONICS OF THE LOCAL OSCILLATOR, ALWAYS USE THE HIGHEST FREQUENCY SETTING OF THE DIAL (LOWEST HARMONIC) FOR MAXIMUM SENSITIVITY.

3. Place METER RANGE switch in either 20 kHz, 6 kHz, or 2 kHz position and read deviation directly on meter scale. If the local oscillator frequency is below the signal frequency, the meter will indicate deviation on the high side of carrier, when the (+) (–) switch is in the (+) position. (Peak deviation is equal to one half the sum of the (+) and (–) deviation readings.) Unequal positive and negative readings indicate modulation asymmetry.

b. DISTORTION MEASUREMENTS

1. Tune the Model 1323 to the transmitter signal as described in Section 6 Paragraph a, then connect a suitable distortion meter to the SCOPE jack.

Inherent distortion in the Model 1323 is normally less than one per cent of the 10 kHz deviation level.

c. NOISE MEASUREMENTS

1. Residual carrier noise may be measured by connecting a high impedance audio frequency voltmeter to the SCOPE jack. The inherent noise of the Model 1323 is approximately –45 db at 150 MHz, standarized at 10 kHz deviation, and at 1 kHz modulating frequency.

NOTE

BOTH DISTORTION AND NOISE MEASUREMENT MAY BE MADE AT THE SPKR. JACK IF IT IS DESIRED TO MAKE THE MEASUREMENTS THROUGH A 750 MICRO-SECOND DE-EMPHASIS NETWORK. IN THIS CASE THE AUDIO LEVEL CONTROL SHOULD NOT BE TURNED UP SO HIGH THAT CLIPPING TAKES PLACE.

7. MAINTENANCE

a. GENERAL PRECAUTIONS

1. The purpose of this section is to aquaint operating and maintenance personal with procedures for making certain adjustments that may be necessary after critical parts are replaced.

2. It should be noted that most of the field replaceable parts are available from MOTOROLA. Please refer to MOTOROLA's part numbers when ordering. The adjustment procedures outlined in this section should be carefully followed. When the described test equipment is not available, it would be adviseable to return the Model 1323 to Measurements for repair.

b. BATTERY INSTALLATION

1. Remove the four screws from the sides of the back portion of the case. These screws are located, one on each side, approximately 3" in from the back of the instrument.

2. Remove the back portion of the instrument and disconnect the power connector.

3. Remove the battery hold down strap mounted with four screws to the top and bottom of the back of the case.

4. Install batteries being sure to observe polarity as indicated by the markings on the battery holder.

5. Reassemble the back cover of the instrument.

c. REMOVING THE INSTRUMENT FROM THE CASE

1. Disconnect the A.C. Power Pack from the rear of the case and remove the front cover.

2. Lay the instrument on its back and remove the four screws located two on each side and nearest the outside edge of the front panel.

3. Slide the instrument out of its case being careful not to hit the function switch or any of the printed circuit boards.

d. DISTORTION ADJUST.

1. Remove the instrument from its case.

2. Connect an audio oscillator set at approximately 1 kHz to the single terminal cinch strip located on the back chassis of the Model 1323.

3. Switch the METER RANGE switch to the CAL 2 position.

4. Adjust the audio oscillator output for a full scale reading on the Model 1323.

5. Connect SCOPE output of the Model 1323 to the input of a distortion analyzer and adjust R100 for minimum distortion.

e. FILTER TERMINATION ADJUST.

1. Connect an audio oscillator to the single terminal cinch strip located on the back chassis.

2. Monitor the output of the audio oscillator with an oscilloscope or VTVM.

3. Set the audio oscillator at 400 Hz and adjust the output voltage for a full scale reading on M1.

4. Keeping the audio oscillator output constant set the audio frequency to 6 kHz and adjust R136 for a full scale reading on M1.

5. Repeat procedures 3 and 4 until the same reading can be obtained on M1 at both frequencies.

f. DIVIDER ADJUST.

1. Connect an audio oscillator set at approximately 1000 Hz to the wiper of deck E on SW1. (Deck E is located furthest from the front panel)

2. Switch the METER RANGE switch to the 20 kHz position.

3. Connect an oscilloscope or VTVM to the junction of R80 and R82 located on deck E of SW1.

4. Adjust the Divider Adjust. R90 until the voltage at the junction of R80 and R82 is one tenth the voltage as measured at the output of the audio oscillator.

g. METER ADJUST.

1. Switch the METER RANGE switch to the CAL 2 position.

2. Connect an audio oscillator set at approximately 1000 Hz to the single terminal cinch strip located on the back of the mounting chassis.

3. Set the output of the audio generator to 4 volts "peak-to-peak". (1.4 volts r.m.s.)

4. Adjust meter adjust potentiometer R96 for full scale deflection as viewed on meter M1.

h. DISCRIMINATOR ADJUST.

1. Connect a 100 kHz ±1% oscillator to the input connector of the Model 1323.

2. Place METER RANGE switch in the TUNE position, and adjust the signal strength to bring the meter pointer to the blue area of the scale.

3. Place METER RANGE switch in CAL 1 position. The meter should indicate full scale deflection. If necessary adjust R73 to bring the meter reading to full scale.

NOTE

THE ABOVE ADJUSTMENTS "e" THROUGH "h" MAY EFFECT EACH OTHER AND SHOULD BE DOUBLE CHECKED FOR ANY SLIGHT READJUSTMENTS THAT ARE NECESSARY.

i. POWER OVERLOADS (MIXER DIODE CR4) REPLACEMENT

If the input to the Model 1323 exceeds approximately 200 milliwatts, there is danger that mixer diode CR4 may be damaged.

Mixer diode CR4 may be replaced as follows:

1. Remove the instrument from its case.

2. Remove the four screws holding the top shield plate of the local oscillator box which is mounted directly behind the local oscillator tuning dial.

3. Refer to the printed circuit board layout of the local oscillator board and remove mixer diode CR4 from the diode solder clips.

4. "Solder in" the replacement diode being sure to observe the correct polarity.

5. Reassemble the Model 1323.

PARTS LIST

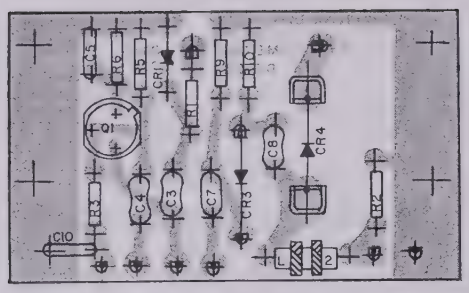
Reference Symbol	Motorola Part No.	Description
		CAPACITORS
C1, 2	21P84250C81	Ceramic Feedthru 1K mmf GMV
C3, 8	8P84250C82	Ceramic Tubular 5 mmf ±10%
C4, 101	8P84250C83	" " 15 " "
C5, 10, 130, 131	21P84250C84	" Disc 1K mmf "
C6	19P84250C85	Var. Air Dielectric 2 sections
C7, 60, 61	21P84250C86	Mica 220 mmf ±10% 100 V
C9	21P84250C87	Ceramic Feedthru 55 mmf
C20, 23, 24, 28, 29, 32, 132, 134-138, 141, 142	8P84250C88	Mylar .01 mf ±20%
C21, 26, 30, 34, 38, 80	23P84250C89	Electrolytic 10 mf 25 V
C22, 27, 31, 33, 35, 36, 37, 39, 99, 100, 105, 139	8P84250C90	Mylar .1 mf ±20%
C41, 81	21P84251C02	Mica 68 mmf ±10% 100V
C63	21P84251C03	Mica 47 mmf
C65	8P84251C04	Ceramic Tubular 10 mmf ±10%
C64, 67	8P84250C91	Mylar .22 mf ±20%
C68	21P84250C92	Mica 150 mmf ± 10% 100 V
C62, 66, 69	23P84250C93	Electrolytic 50 mf 15 V
C90	23P84250C95	Electrolytic 250 mf 12 V
C91, 93, 96	23P84250C96	Electrolytic 50 mf 12 V
C92, 94, 97	21P84250C97	Ceramic Disc 2.2K mmf GMV
C95, 104	23P84251C30	Electrolytic 100 mf 12V
C98, 106	23P84251C31	Electrolytic 25 mf 25V
C102, 133	23P84250C99	Electrolytic 2 mf 50V
C103	21P84251C01	Ceramic Disc 470 mmf ±10%
C120, 121	23P84251C05	Electrolytic 1000 mf 25 V
C140	21P84251C06	Mica 270 mmf ±10% 100 V

Reference Symbol	Motorola Part No.	Description
		DIODE
CR1	48P84309A04	V12E
CR2	48P84309A01	1N5235A
CR3, 20, 21, 60	48P82358D33	1N273
CR4	48P82583B01	1N82AG
CR5, 6	48P84309A03	2F4, Rectifier
CR61	48C82420C03	1N914
C62, 80, 131, 132	48P83624E44	1N270
CR130	48P84309A02	1N5237B
		FUSES
F1	65P84251C07	MDL 1/8 amp. slo-blow
F120	65X21975	AGC 1/2 amp.
		CONNECTORS
J1	9P84251C08	UG-625B/U
J2	9P84251C09	Receptacle
J3	9P84251C10	Socket
J4, 5	9P84308A99	Jack Scope & Speaker
		COILS
L1	24P84308A95	R.F. Oscillator Coil
L2, 20	24P84308A96	R.F. Choke
L130	24P84308A97	Filter Coil
L131	24P84308A98	Var. Inductor
		METER
M1	72P84308A94	Meter
		RECEPTACLES
P1	28P84251C11	Plug
P2	28P84251C29	Plug
P3	28P84251C12	Plug
P5	28P84251C13	Plug

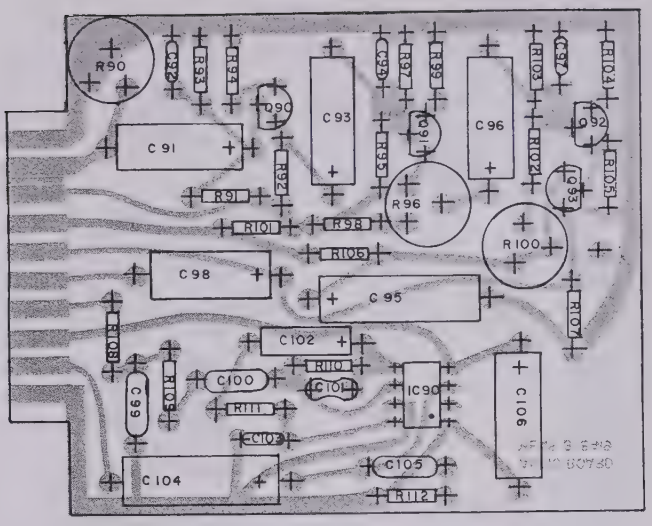
Reference Symbol	Motorola Part No.	Description
		TRANSISTORS
Q1	48P84308A92	2N2369
Q20, 21-27, 60-64, 90-93, 133	48P84305A12	2N4123
Q130, 131	48P84305A10	2N5294
Q132	48P84308A93	2N3905
IC90	51P84308A86	MC-1306P Audio Output Stage
		SWITCHES
SW1	40P84308A87	Meter Range
SW2	40P84308A88	Deviation
SW3	40P84308A89	Power Select
SW4	40P84308A90	Power
		TRANSFORMER
T1	25P84308A91	Transformer
		RESISTORS
R1	6R129146	Fixed Comp 150K ± 10% 1/4W
R2, 66, 68	6R128902	" " 47K " "
R3, 71	6R128904	" " 18K " "
R4, 85	18P84251C14	Var. 10K ±20% 1/2W
R5	6R127804	Fixed Comp. 4.7K ±10% 1/4W
R6, 7, 25, 32, 39, 48, 49, 69, 135	6R129753	" " 100 ohms ±10% 1/4W
R8	6R129145	" " 82 K ±10% "
R9, 101	6K127801	" " 470 ohms ±10% "
R10, 99, 106	6R129861	" " 68 " " "
R11, 141	6S10053A30	" " 51 " ± 5% "
R12	6S10053A47	" " 510 " " "
R20, 26, 30, 34, 40, 45, 91, 95	6R127807	" " 33 K ±10% "
R21, 28, 33, 37, 52, 63	6R128689	" " 2.2 K " "
R22, 27, 31, 36	6R129433	" " 5.6 K " "
R23, 29, 35, 38, 142	6K129775	" " 330 ohms ± 10% 1/4W

Reference Symbol	Motorola Part No.	Description				
		RESISTORS				
R24, 44, 65, 70, 72	6K127802	Fixed	Comp.	1 K	±10%	1/4W
R41, 46	6S10053A57	”	”	6.2 K	± 5%	”
R42, 47, 111	6K129235	”	”	1.2 K	± 10%	”
R43, 64, 75	6K129862	”	”	150 ohms	”	”
R50, 103	6R128687	”	”	6.8 K	”	”
R51	6R129231	”	”	3.3 K	”	”
R53, 61, 102	6R128685	”	”	22 K	”	”
R54	6R129754	”	”	33 ohms	”	”
R55, 60, 92, 105	6K128599	”	”	680 ”	”	”
R56, 62, 143	6R127805	”	”	15 K	”	”
R67	6R127806	”	”	27 K	”	”
R73	18P84251C15	Var.	”	100 ohms	±20%	3/8W
R74, 140, 146	6K129620	Fixed	”	560 ”	±10%	1/4W
R80	6P84251C16	”	”	900 ”	± 1%	1/2W
R81	6P84251C17	”	”	666 ”	”	”
R82	6P84251C18	”	”	111 ”	”	”
R83	6P84251C19	”	”	500 ”	”	”
R84	6S10053A65	”	”	30 K	±5%	1/4W
R86	18P84251C20	Var.	”	1 K	±20%	1/2W
R90	18P84251C21	”	”	5 K	”	3/8W
R93, 97	6S10053A58	Fixed	”	7.5 K	± 5%	1/4W
R94, 104	6R129224	”	”	82 ohms	±10%	”
R96	18P84251C22	Var.	”	250 ”	±20%	3/8W
R98	6S10053A46	Fixed	”	430 ”	± 5%	1/4W
R100	18P84251C23	Var.	”	25 K	± 20%	3/8W
R107	6K129863	Fixed	”	390 ohms	± 10%	1/4W
R108	6R129225	”	”	10 K	”	”
R109	6S10053A58	”	”	75 K	± 5%	”
R110	6R129226	”	”	100 K	± 10%	1/4W

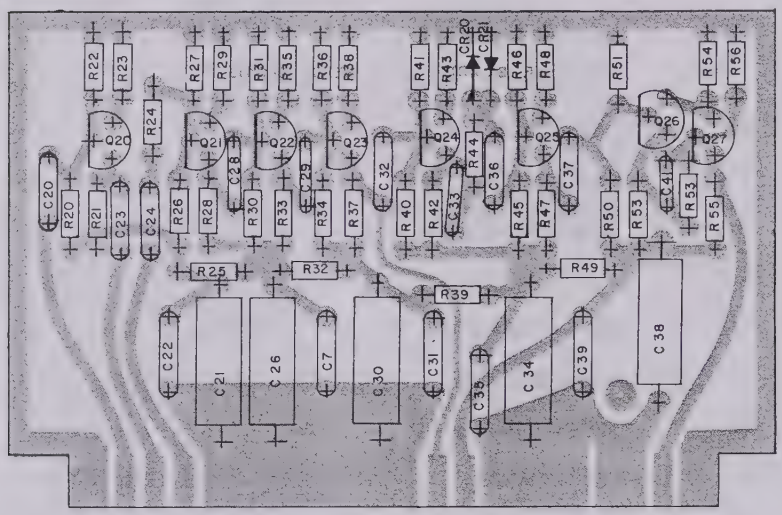
Reference Symbol	Motorola Part No.	Description
		RESISTORS
R112	6K129755	Fixed Comp. 10 ohms ±10% 1/4W
R120	6R476059	" " 15 " " 2W
R121	6R3961	" " 39 " ± 5% 1/2W
R130	6P84251C24	" " 280 K ± 1% "
R131	6K129662	" " 180 ohms ± 10% 1/4W
R132	6S131289	" " 910 " ± 5% "
R134	6S10053A43	" " 300 " " "
R136	18P84251C25	Var. " 1 K ± 20% 3/8W
R137	18P84251C26	" " 10 K " "
R138	6R129230	Fixed " 12 K ± 10% 1/4W
R139	6S10053A59	" " 9.1 K ± 5% "
R144	6S10053A56	" " 4.3 K " "
R145	6R129526	" " 33 K " "
R147	6S10053A40	" " 160 K " "
		MISCELLANEOUS
	36P84308A77	Vernier Drive Knob
	36P84308A78	Fine Tuning Knob
	36P84308A78	Audio Level Knob
	36P84308A78	R. F. Gain Knob
	36P84308A79	Meter Range Knob
	1P84308A80	I.F. P.C. Bd., Assy.
	1P84308A81	Pulse Network P.C. Bd., Assy.
	1P84308A82	Audio P.C. Bd., Assy.
	1P84308A83	Filter P.C. Bd., Assy.
	1P84308A84	Local Osc., P.C. Bd., Assy.
	50P84308A85	Speaker, 8 ohms .2W



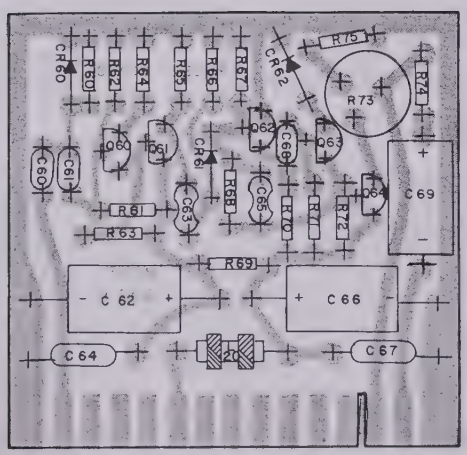
LOCAL OSC.
PR. CIR. BOARD
1P84308A84



AUDIO
PR. CIR. BOARD
1P84308A82



I. F.
PR. CIR. BOARD
1P84308A80



PULSE NETWORK
PR. CIR. BOARD
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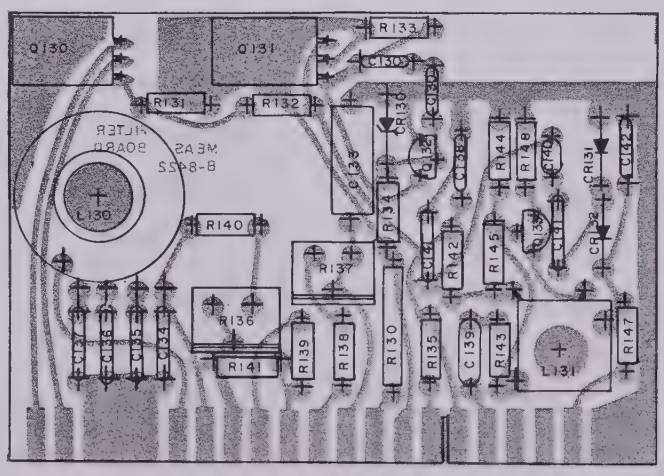
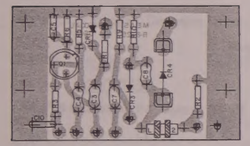
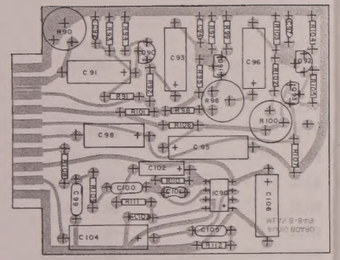


FILTER
PR. CIR. BOARD
1P84308A83



LOCAL OSC.
PR. CIR. BOARD
1P84308A84



AUDIO
PR. CIR. BOARD
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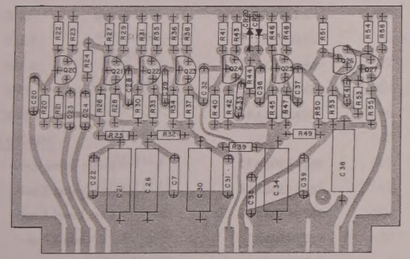
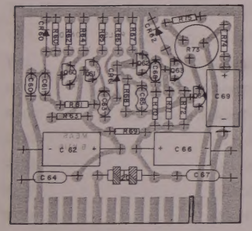
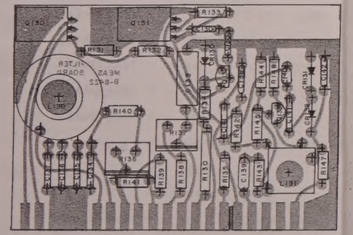


I. F.
PR. CIR. BOARD
1P84308A80



PULSE NETWORK
PR. CIR. BOARD
1P84308A81



FILTER
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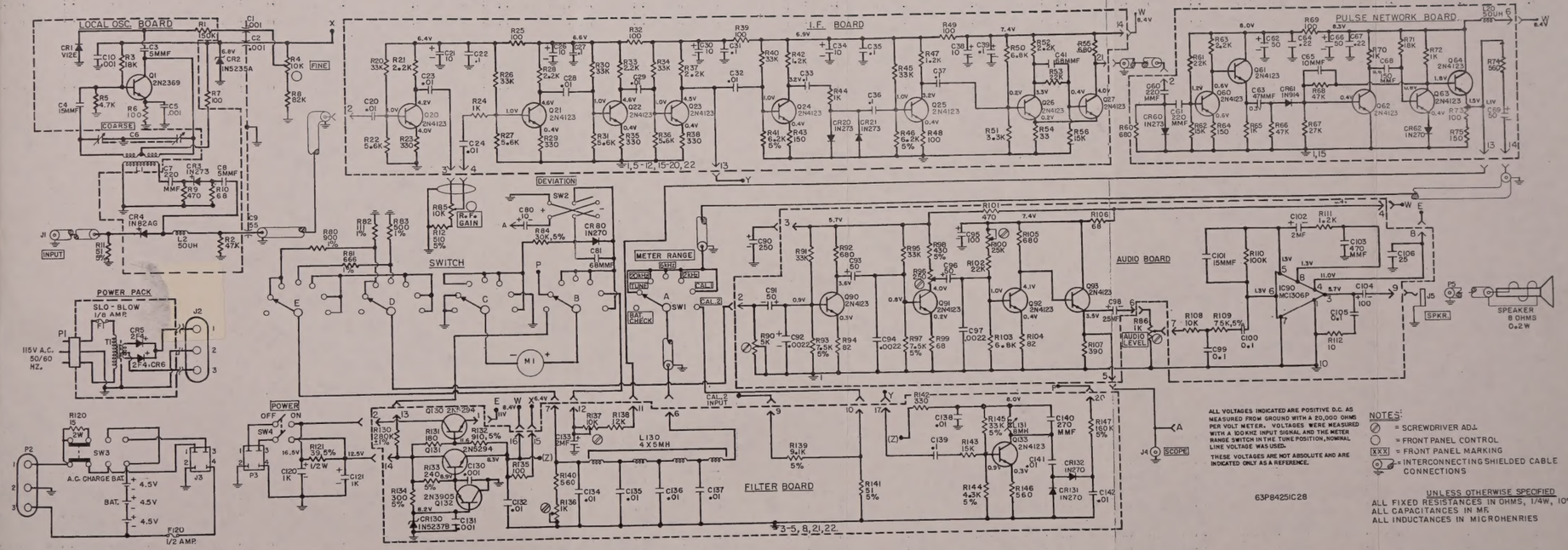
LOCAL OSC. BOARD
I.F. BOARD
PULSE NETWORK BOARD
AUDIO BOARD
FILTER BOARD
POWER PACK
SLO-BLOW 1/8 AMP.
115V A.C. 50/60 HZ.
SLO-BLOW 1/2 AMP.
A.C. CHARGE BAT.
BAT. 4.5V 4.5V 4.5V
SWITCH
METER RANGE
DEVIATION
POWER OFF ON
INPUT
FINE
COARSE
SPEAKER 8 OHMS 0.2 W
SCOPE
ALL VOLTAGES INDICATED ARE POSITIVE D.C. AS MEASURED FROM GROUND WITH A 20,000 OHMS PER VOLT METER. VOLTAGES WERE MEASURED WITH A 100KHZ INPUT SIGNAL AND THE METER RANGE SWITCH IN THE TUNE POSITION, NOMINAL LINE VOLTAGE WAS USED.
THESE VOLTAGES ARE NOT ABSOLUTE AND ARE INDICATED ONLY AS A REFERENCE.
63P8425IC28
NOTES:
= SCREWDRIVER ADJ.
= FRONT PANEL CONTROL
XXX = FRONT PANEL MARKING
= INTERCONNECTING SHIELDED CABLE CONNECTIONS
UNLESS OTHERWISE SPECIFIED
ALL FIXED RESISTANCES IN OHMS, 1/4W, 10%.
ALL CAPACITANCES IN MF.
ALL INDUCTANCES IN MICROHENRIES

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